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FINAL REPORT
OF THE LIVING LABORATORY NATIVE PLANT
ECOSYSTEM DEMONSTRATION
PROJECT

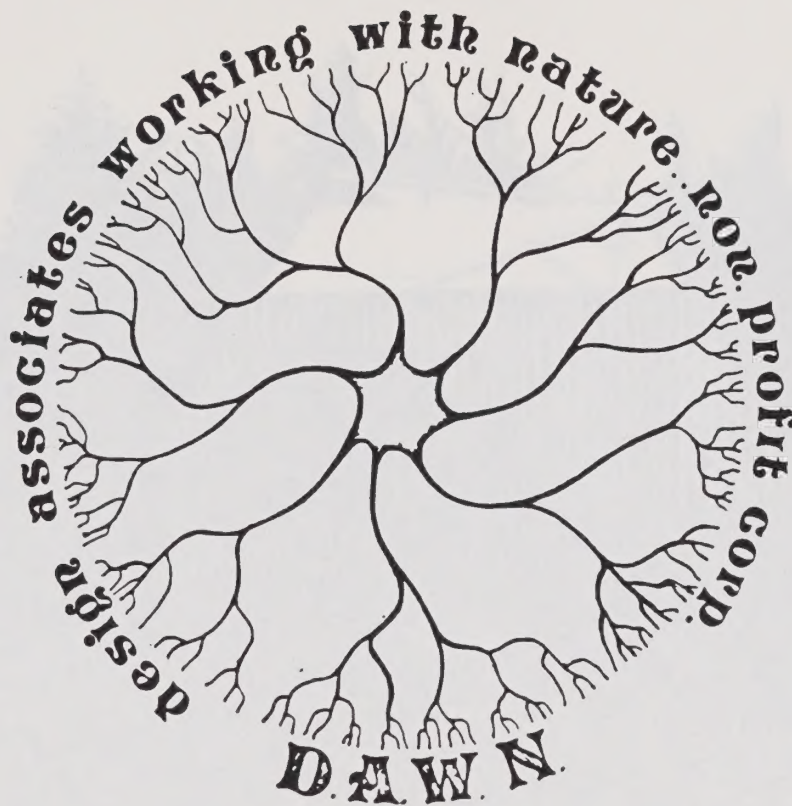
FISCAL YEAR 1980

Submitted to the Waterfront Advisory Board

by

THE DAWN CORPORATION

January, 1981

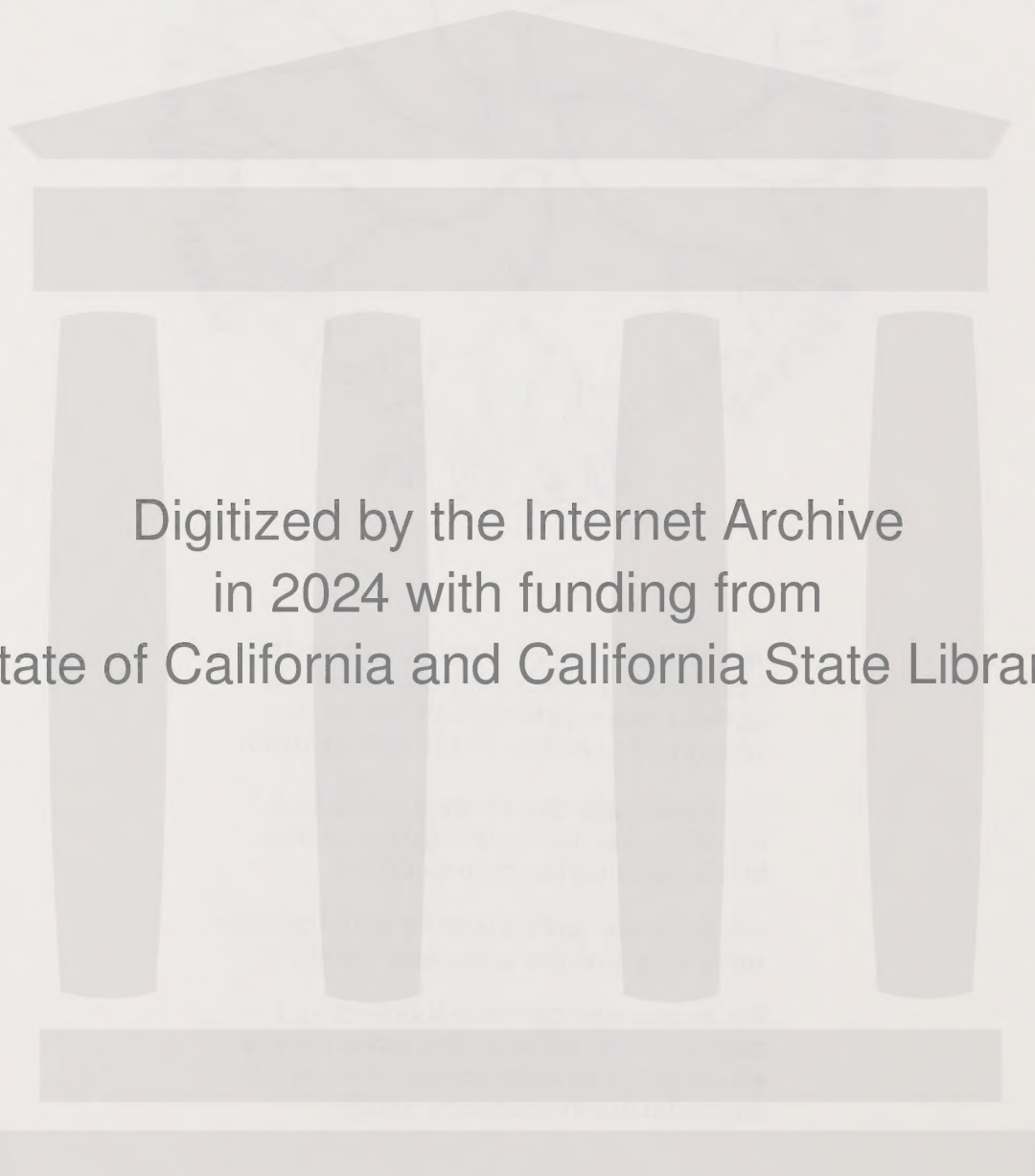


We educate the general public on the ecological and recreational value of natural eco-systems and the evolutionary process of land regeneration.

We encourage the protection of and increased contact with native plants, birds and marine communities.

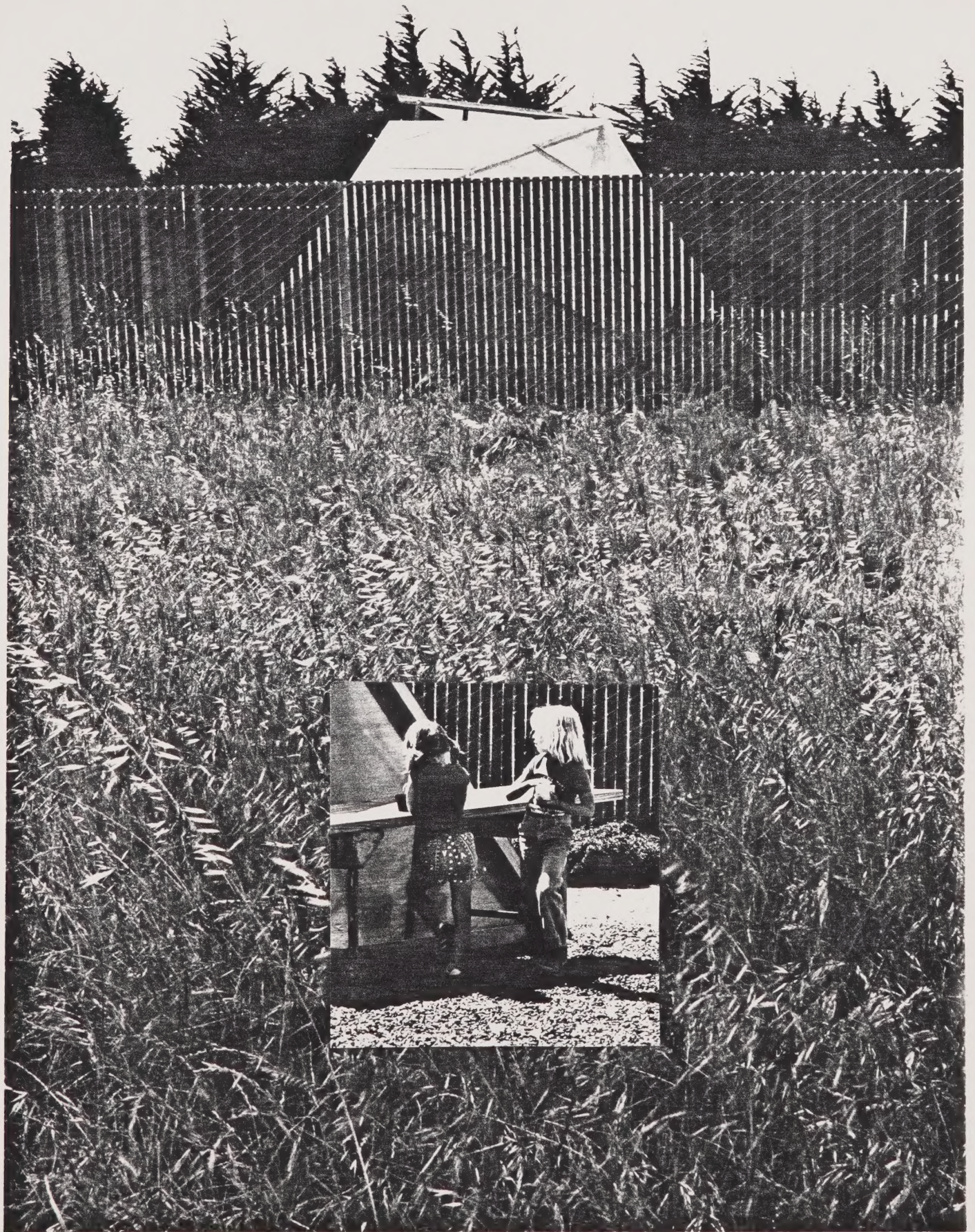
We promote park planting and development to allow for complete habitats.

We encourage the development and regeneration of land into urban parks which provide open space to meet all community recreational needs.



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One thing which a good farmer quickly learns is that in fighting nature he will always be defeated but that in working with her, he can make remarkable and immensely profitable progress.

Louis Bromfield - Malabar Farm

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A LETTER FROM THE PRESIDENT --

We have accomplished the physical reality of a plant propagation grounds and the production of appropriate native plants for planting Phase I of the Berkley North Waterfront Park development. We planted demonstration areas and research plots to determine some of the future vital questions as to site-hardiness of plant material with anticipated loss due to existing rodents and plant competition. We compiled a complete list of existing flora and evaluated their potential threat as to future weed competition and collected seed of a number of otherwise unavailable native plants. We began an educational outreach program and have made base contacts with many organizations and individuals of the Bay Area. DAWN is an educational organization compiling information on land regeneration and natural ecosystems. We are projecting an evolutionary standard in our field, understanding primary stages necessary before many plant communities can be introduced and the importance of a successful land management program.

I would like the community at large to join us in our efforts, creating an environment, responsible to the future and the resources at hand.

I would like to acknowledge and thank all volunteers who have contributed with materials and support:

Stanley Bevet
Mark Blumler
Tom Brit
Cathe Britton
Sterling Bunell
Mary Conlan
Steve Crumley
Steve Feldstein
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Peter Jaquith
John Kipping
Clem Lisamke
Monica Loobkoff
Don Mahoney
Bill Olkowski
Etta Pelton
Gail Penso
Shirley Ramacher
David Riggle
Mary Ann Brooke Ross
Hunter Wallof

Warmly,

Don Cook
President

FOREWORD

Since the spring of 1975, when the Berkeley Waterfront Advisory Board and the Berkeley City Council began public meetings on the conversion of the 90-acre Berkeley landfill dump site into a community park, conservation-minded citizens and organizations have expressed along with DAWN a strong concern that some remnant of our once wild and beautiful shoreline be preserved within this park : a reminder to future generations of the ever-present need for protection of our native heritage. Nearly everyone consulted -- lay and professional alike -- has approved of this plan in principle. The reestablishment of typical coastal habitats and the use of native plants on the Bayshore has proven to be a very popular concept.

But while popular approval of native plants was welcome, it in itself was not enough. Some way had to be found to accommodate both community recreational needs and preserve our native plant heritage -- within the same park. Toward this end DAWN proposed in 1979 that the original native bunchgrassland be restored at the Berkeley Waterfront Park, to be used as the main landscape planting motif.

Why native perennial bunchgrasses? The first problem with combining native ecosystems with high-use recreation areas is the incompatibility of the traditional park plant materials and maintenance practices with native plant communities and their specific maintenance needs. The second problem is the high cost of building and maintaining traditional parks. Despite the passage of Proposition 13, we are currently building more parks than we can adequately maintain in future years. Adding special maintenance areas -- like coastal ecosystems -- compounds the problem. These two problems can be solved by using native bunchgrasses as the overall park planting theme.

First, bunchgrasses are competitively compatible with native shrubs and flowers because they are part of the same naturally evolved ecosystem. Small islands of native areas won't be swamped out by an ocean of aggressive turf grasses and their associated weeds, as in the traditional park. Conversely, bunchgrasses are tough enough to withstand a lot of traffic and play. The intensively-used playfields, etc., can be planted with grasses compatible with bunchgrasses and subject to approximately the same maintenance regimen.

Second, costs can be kept close to low agricultural levels because bunchgrasses lend themselves to agricultural machinery, planting, and maintenance techniques such as are currently used in general range management. The low fertility and water requirements of most native plants and bunchgrasses will insure that maintenance costs will remain low even while fuel prices rise and water tables drop.

The next problem for study was the implementation of this new park management concept. We felt that the most serious obstacle to successful implementation was the wide gap that exists between the architect or planner and the maintenance or management team. Land regeneration is a relatively slow and evolutionary process, especially in land reclamation projects like the North Waterfront Park. It is also a highly skilled endeavor. Costs will come down only in proportion as maintenance skill -- and proper advance maintenance planning -- go up.

Now, because good integration of design and maintenance perspectives are critical to project success, responsibility for field results do not end with the final inspection of the landscape planting. Someone has to be around to fill the gap between architect and maintenance person, to insure that good community input and good park design become a reality. It is in this respect that competent park development is like competent farming: an attitude of responsibility for future results and a caring attitude over many years for even the smallest maintenance details.

Therefore, DAWN undertook an in-depth maintenance research project and cost analysis (Departure Beyond II and III, 1979) in order to aid the City of Berkeley design staff in the implementation of its publicly mandated commitment to both recreation and conservation. Maintenance data -- including a complete annual maintenance schedule with costs -- was made available to the City before the park design was drafted. DAWN undertook this project on its own because of the responsibility that we felt both to the community and to the preservation of our native heritage. It is our hope that this low-cost and aesthetically pleasing natural approach to park development will be gradually incorporated into the North Waterfront Park. DAWN dedicates all of its resources to this end. We will continue to strive to be of service to the City of Berkeley in this timely task.

Dennis Rogers
Vice President

REPORT

THE LIVING LABORATORY NATIVE PLANT ECOSYSTEM DEMONSTRATION PROJECT

In the summer and fall of 1979 DAWN proposed to the Waterfront Advisory Board a one-year native plant ecosystem demonstration project. The primary purpose of the proposal was to demonstrate that the native plants and grasses currently not available in the trade could be produced for the Waterfront Park and the value of a small efficient growing grounds could be seen. In addition, DAWN would redevelop and integrate educational programs and report to the City on the progress and expenditures of the project. The City provided the fence, electricity, and \$8,000 for the project. (See Table 1.) Upon approval by the City Council, the project began in early February 1980.

On the first day of spring 1980, after the completion of the fence, greenhouse, and the shade cloth area, DAWN held an open house and dedication ceremony at the Living Laboratory. An outline of the basic objectives of the project was distributed. They were:

1. Inventory: Record species composition and abundance of plants now at the site; set out transect sites to record seasonal and annual changes in type and composition of the vegetation.
2. Propagation: Collect and propagate appropriate native plants for the site including native perennial grass species, annual wildflower species, and shrub and tree species common in nature but difficult to obtain in the nursery trade.
3. Develop an Educational Program: Provide an educational resource, coordinating programs with interested schools and organizations, encouraging community participation, and holding weekend workshops and field trips.
4. Develop design and maintenance procedures for the use of California native plants in urban reclamation projects, defining, establishing procedures and publishing this report for general distribution, outlining the first year's progress of the Living Laboratory programs.

Table 1

Cost Breakdown

1.	Greenhouse	\$1,000.
2.	Lath area and miscellaneous construction materials . .	600.
3.	Plant propagation material	1,000.
4.	Soil amendments	300.
5.	Containers	500.
6.	Publication and communication costs	600.
7.	Management and supervision costs	<u>4,000.</u>
	TOTAL	\$8,000

D. A. W. N.

DESIGN ASSOCIATES WORKING WITH NATURE

a non-profit corporation

DISPLAYS

A LIVING LABORATORY

**an educational facility demonstrating
coastal california native plant ecosystems**

Berkeley Ordinance #5225

INVENTORY

Transect sites were established on both the dump lands and the vacant Santa Fe lands just north of University Avenue. These will be observed for several seasons. The vegetation survey was taken during the spring and summer of 1980. Aside from just a list of names, the vegetation survey gives the land manager a handle on just what plants and weeds will be competing for space in the new introduced landscape. Knowing their life cycle and type, perennial or annual, gives important information for weed control and establishment procedures for the new landscape. It is interesting to note that 12 native coastal perennials were establishing themselves on some of the older mounds on the southwest end of the site. Finally, the vegetation survey becomes a flora of the weeds in our coastal urban development. (See Appendix.)

PROPAGATION

By the March 22nd open house, the season of collecting seed and cuttings had passed. However, arrangements had been made prior to the project to obtain representative cuttings and seed stock from interested growers. All the material produced came from that season's cutting and seed crop. This "liner material," as it is commonly called, was moved into one- and two-gallon containers in the late spring and early summer. 41 species were produced. Approximately a quarter of these are not available in the nursery trade. 1192 one-gallon plants and 290 two-gallon plants were produced. The list of plants was presented to Doug Wolf of the City design staff on December 4th. Notations on placement, substitutions, numbers, and species to be used by the City for their phase one development were agreed upon. 16 species including all perennial grasses were held for future use and the rest were earmarked for planting this year. (See Table 2.)

Valuable seed was collected in the 1980 season. Some of this seed was saved for distribution to interested organizations and individuals. Most of the seed will be tested and propagated in the 1981 season.

Three demonstration areas were established. A pair of exclosures with planted native perennial grasses inside and outside were placed in the adjacent annual grassland just north of the Living Laboratory. Liner stock of native *Stipa pulchra*, Purple Needlegrass, purchased with funds from the CNPS were planted in a 900 sq. ft. area inside the Living Laboratory approximately two feet with other native perennial grasses and wildflowers. No supplemental watering was used. Rabbit browsing was noted on the perennial grasses but the grasses continued to grow in size and basal

Table 2. List of plants produced at the Living Laboratory, 1980, with placement recommendations.

Species	Number	Size	Zone
<i>Arctostaphylos densiflora</i>	30	1 gal	6b,7b
<i>A. edmundsii</i>	41	1 gal	5b,6c
<i>A. franciscana</i>	43	1 gal	6b
<i>A. Uva-ursi</i> (Arcata hybrid)	22	1 gal	5b,6b
<i>Armeria maritimus</i>	2	1 gal	6c
<i>Artemesia californica</i>	10	1 gal	5b-7b
<i>A. c.</i> (prostrate)	4	2 gal	4b,5b,6c
<i>Baccharis pilularis pilularis</i>	93	1 gal	4b,6c
<i>Calamagrostis nutkaensis</i>	45	1 gal	4c-e,5b,6b
<i>Ceanothus arboreus</i>	2	2 gal	6b,7b
<i>C. gloriosus</i> (blue)	92	1 gal	5b,6c
<i>C. griseus horizontalis</i> (blue)	72	1 gal	5b,6b,c
<i>C. herastiorum</i> (dark blue)	94	2 gal	5b,6c
<i>C. papillosus roweanus</i> (purple)	8	2 gal	7b
<i>C. rigidus albus</i> (white)	9	2 gal	6b
<i>C. thrysiflorus</i> (blue)	47	2 gal	5b-7b
<i>C. t.</i> (white)	44	2 gal	5b-7b
<i>Cupressus guadalupensis</i>	46	1 gal	-----
<i>Eriogonum arboresense</i>	15	1 gal	5b,6b,c
<i>E. fasciculatum</i>	15	1 gal	5b,6b,c
<i>E. giganteum</i>	12	1 gal	6b,c
<i>E. latifolium rubensense</i>	43	1 gal	-----
<i>Eriophyllum staechadifolium</i>	1	2 gal	5b,6b,c
<i>Erysimum concinnum</i>	9	1 gal	5b,6b,c
<i>Festuca californica</i>	50	1 gal	4c-e,6b
<i>Gindelia maritima</i>	14	1 gal	5b,6b,c
<i>Heteromeles arbutifolia</i>	87	1 gal	6b,7b
<i>Juncus</i> spp.	13	1 gal	5b
<i>Myrica californica</i>	180	1 gal	4c-e,6b,7b
<i>Pinus torreyana</i>	24	2 gal	7b
<i>Prunus lyoni</i>	50	1 gal	6b,7b
<i>Rhamnus californica</i>	43	1 gal	5b-7b
<i>Rhus integrifolia</i>	54	1 gal	6b,7b
<i>Ribes viburnifolium</i>	11	1 gal	5b-7b
<i>Salix</i> spp.	5	1 gal	4e,5b-7b
<i>Sambucus</i> spp.	2	5 gal	7b
<i>Salvia mellifera</i>	4	2 gal	6b,7b
<i>S. m.</i> (prostrate)	51	2 gal	5b,6b,c
<i>S. spathacea</i>	8	1 gal	5b
<i>Stipa lepida</i>	70	1 gal	7b
<i>S. pulchra</i>	50	1 gal	5b,6b
<i>Vaccinium ovatum</i>	13	1 gal	5b



area. Grazed tufts continued to be green and non-grazed plants maintained green bases. All the planted grasses developed seed and some developed heights in excess of two feet before dormancy. Some of the perennial grass seed collected this past season will be planted inside the Living Laboratory in the established Needlegrass area. The purpose of this will be to test the vigor and response of four major perennial grass species to seeding and watering regimes.

DAWN ended the construction phase with the building of the bottom heat propagation bed to complete the facilities propagation program. This enables the Living Laboratory to propagate its own seed and cuttings, emphasizing the common native plants and grasses not in the nursery trade.

EDUCATION PROGRAM

It is a major objective of DAWN to run the Living Laboratory as an educational resource. Therefore, much effort was made to contact interested organizations and schools. Volunteers and staff of DAWN made an effort to establish Saturday open house work days throughout most of 1980. In addition, two major open houses were held during the year. The basic objectives of the Living Laboratory education programs were to: 1) provide an opportunity for people to experience a diverse ecosystem native to California's coast and the Greater Bay Area; 2) expose people to the process and techniques of plant production and land reclamation with coastal native plants; and 3) to demonstrate the potential of creating and sustaining a natural environment.

Initial contact was made with interested Berkeley school administrators. Response from Dr. Tony Rinaldi, the District Science Coordinator, and Henry Nelson of the Berkeley High School Science Department, was favorable but due to last minute cancellations in the spring, no meetings with the High School and Jr. High School teachers planned at the Living Laboratory took place. Two basic problems with public school systems presented themselves: 1) transportation -- the cost of bussing children to the Living Laboratory is great, and the school bussing budget was limited; and 2) it was difficult to organize enough time for a meaningful presentation with the rigid school system. This was especially true for DAWN saturday work days which were ideal for the DAWN volunteers, but failed to get substantial response from public teachers and students. In reality, a one-shot "come and see" tour has its limitations. While it will be of value for teachers and administrators, a more comprehensive package is needed for the students. DAWN plans to assemble a short slide presentation and ecosystem program to be carried to the schools to build



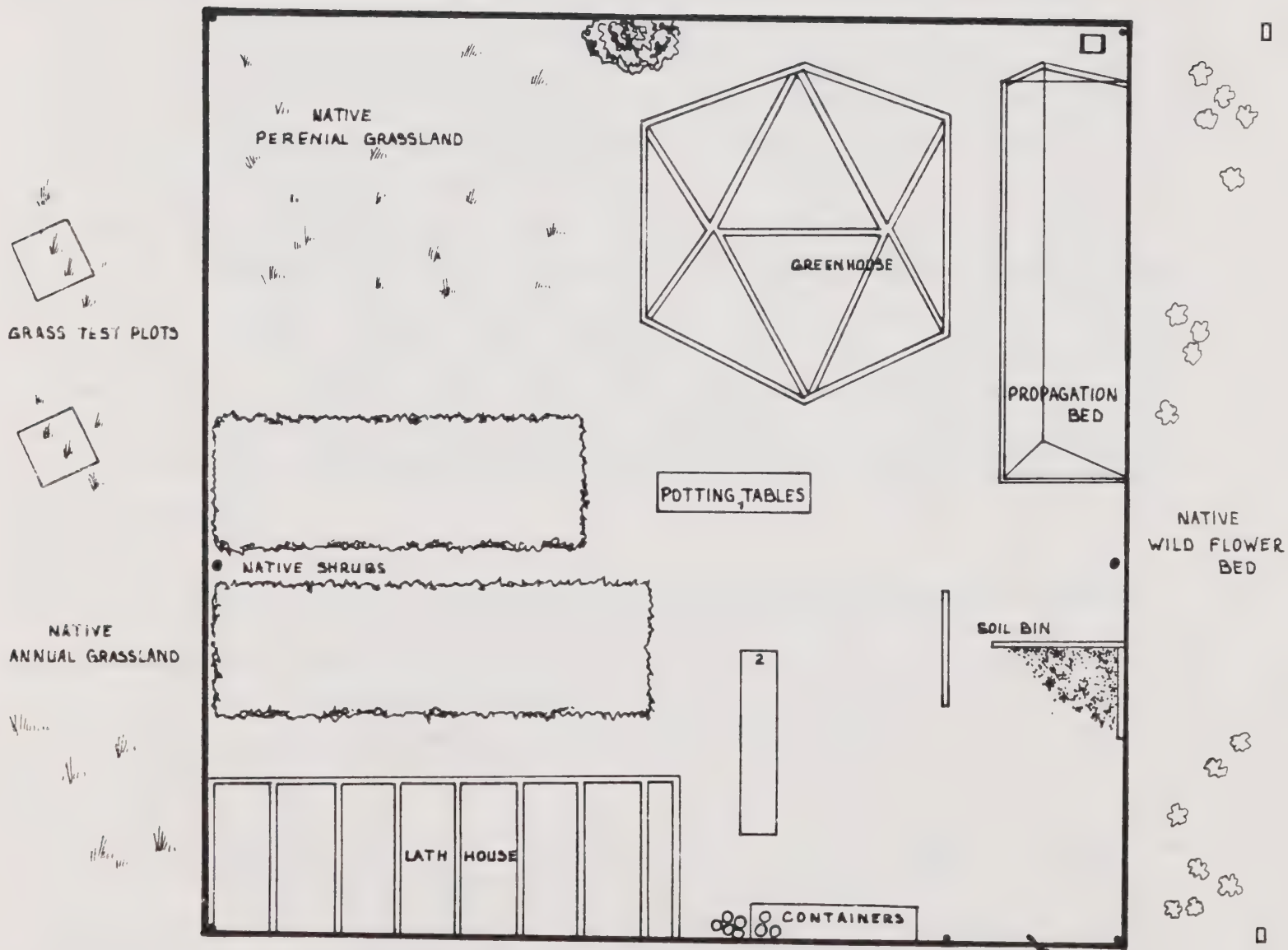
teacher/student interest.

By far the greatest success was achieved with the City's own summer camp program held at the marina near the Adventure Playground. Several field trips were conducted with the children ranging in ages from six to twelve. The Living Laboratory was at its peak in production and the three demonstration areas well established. The main theme of the presentation was "native ecosystems past and present." Field trips onto the dumpsite were held. Plant adaptations, seeding strategies, and identification tips were explained to the children. Some groups returned to rediscover plants they learned before. This program has great potential for 1981. DAWN is exploring the idea of a "native plant ecosystem workbook" to be used with the program.

The San Francisco Chapter of the California Native Plant Society donated \$500 to DAWN for research into native perennial grassland species. DAWN and Inquiring Systems Incorporated (ISI) traded membership and held three productive meetings outlining future working relationships with regard to mutually similar education and grant goals. ISI has been involved in programs like Washington School Environmental Yard. Most recently DAWN has contributed to ISI's recent proposal, Project All (Appropriate Landscapes for Learning) at Longfellow School. DAWN joined "In Dulci Jubilo, Inc.," a Berkeley based non-profit organization that works with children in art and physical environment improvement. Discussions with Ernest Landauer of CAMPS Inc., Berkeley, revealed areas of cooperation between DAWN and CAMPS Inc., concerning transportation problems and ecosystem education. This fall DAWN proposed to the San Francisco Openspace Committee a feasibility study with the Bernal Heights Neighborhood Association in San Francisco for a Bernal Hilltop Native Grassland Restoration Project. The response from the Committee and the San Francisco Department of Parks and Recreation was very encouraging. No seniors organizations were contacted; however, it is felt that this is an important area for future effort.

The maintenance and watering of the plants at the Living Laboratory was done by DAWN members. The Living Laboratory was monitored steadily throughout the year by the members and staff. Three members of DAWN who teach in Hayward had their children collect and clean all their cafeteria cans and delivered them to the Living Laboratory during the school year. At the rate the cans are being collected, gallon cans will not have to be purchased in the future.





THE DEVELOPMENT OF DESIGN AND MAINTENANCE PROCEDURES FOR THE USE OF CALIFORNIA NATIVE PLANTS IN URBAN RECLAMATION PROJECTS

Following are two examples of the type of service which DAWN has been offering to the City of Berkeley. The first involves assistance in dealing with early winter seeding of native wildflowers in Phase I of the Berkeley Waterfront Park. Range management techniques and properly-timed cultural practices are emphasized. With the banning of herbicide use in City parks, it has become necessary to make use of every cultural method within our reach. The second is a list of California native plant communities and their requisite common plants appropriate at the Waterfront Park site. Many of these plants are not available in the trade, and when established make good competitors in a natural landscape. The native perennial grasses in particular provide a sound foundation for a park compatible with peoples' use and low overall maintenance cost.

Our research into the reestablishment of native bunchgrasses through management tools like range drilling and seasonal mowing -- and the intermediate level technology which must be utilized -- has suggested applications far afield from the urban park setting. Areas for future study are: reforestation and brush control; land reclamation projects involving strip-mine revegetation; soil fertility improvement; wildlife habitat improvement; and preservation of rare or endangered plant species and ecosystems.

An Outline of Design with Maintenance Practices and Needs as Top Priorities

1. Long-range Objectives. Optimum proportion and shape of shrub areas to useable open space, and mutually compatible plant material in order that recreation (useable open space) and conservation (of typical native plant communities) can be accommodated in the same park.
 - A. Shrub and Tree Areas. As these areas fill in, less weeds will be present. High irrigation needs for the first year will favor weeds resulting in expensive hand weeding. This is also true for drip irrigation systems, especially in clay soil. Cost of initial irrigation system is great and irrigation system maintenance is an important factor.
 - B. Grassland Areas. The open spaces between the shrub areas will be potentially high maintenance areas, therefore the need for useable open space

can best be met by low maintenance grassland. Grassland maintenance lends itself well to the alternatives of mechanization for initial establishment and long range maintenance. Grasses have a wide adaptability to soil, water regimes, and weed competition resulting in low maintenance costs. Proper timing and maintenance practices are critical in the establishment period to control weed competition.

2. Types of mechanization, timing, and planned maintenance practices vs. herbicides and intensive labor. As reliance of herbicide goes down, intelligent planning and daily informed observation go up. This is the heart of the Integrated Pest Management (IPM) concept. Without chemicals, cultural factors become all important.

- A. Bunchgrasses as grassland. Example: Scaldis Hard Fescue. (Resembles the native Idaho Fescue, low and fine bladed, and available from seed growers.) This grass is compatible with native wildflowers and perennials, will hold its ground well against invasion from annual grasses once established, and needs no supplemental fertilizer after establishment. Most important, it lends itself to economical mechanization in planting, establishment and maintenance without the use of herbicides, etc.

- 1) Seed for drilling
- 2) Mowing for annual competition
- 3) Swathing clipping and mulch manipulation
- 4) Annual seed re-drilling
- 5) Portable aluminum irrigation for first year

- B. Design implications. The open space should be shaped to accommodate the machinery necessary to accomplish the establishment and maintenance of the grassland.

3. Short-range objectives consistent with above maintenance practices.

- A. Shrub and tree areas. By keeping shrub and tree areas localized, the necessary maintenance methods may be practiced during the grassland's critical establishment period. Supplemental water and fertilizer is needed for best long-run weed control. Rodent screens are a must, but good sustained growth is the best protection from predators. Already stabilized perennial grassland areas are good sites for the introduction of shrub and tree areas.

B. Grassland areas. This includes mixed wildflower and grass seed mixes. Establishment procedures should work with the seasons. If the City can wait until spring for seeding grassland, the following techniques can be used:

- 1) Allow fall rains to bring up weeds, till under and repeat as weather allows until early spring.
- 2) Use the application of ammonium sulphate fertilizer (21-0-0) as pre-emergent all winter and into early spring. This will also kill many germinating summer annuals.
- 3) Seed drill Hard Fescue with fineleaf perennial rye as a nurse crop with local fertilizer for fast growth.
- 4) Use portable irrigation through spring and summer. Seeding grassland in the spring has several advantages over fall seeding. There is more time to bring up and kill weeds. With warmer temperature for optimum growth, grass (and other seeded species) will fill in faster, resulting in better long-range weed control. Portable irrigation system needs to be used for only six months. Perennial grass will occupy ground the following fall when summer-dormant annual grass seed would normally germinate and establish themselves.

C. Native plant communities. Techniques used in initial Hard Fescue bunchgrassland can be extended gradually to new phases of the Park development where native *Stipa* and *Danthonia* species can be planted. A native seed source can be developed within the Park and original California grassland reinstituted in a natural open space landscape.

Appropriate Native Plant Communities for the Waterfront Park

1. Coastal Strand. Sandy beaches, dunes and adjacent soils. Annual rainfall 15 to 70 inches with much fog and wind. 12-month growing season. Vegetation low or prostrate, often succulent. Some species of this community reach their southern limit at Cape Mendocino, some at Monterey Peninsula, and some at Point Conception. Many of the species exist along the Bayshore. Mt. San Bruno in San Francisco has representation of this plant community. This plant community intergrades with both the coastal prairie and forest communities. Common native plant species in this community are:

Sand Verbena	Bush Lupine	Seaside Daisy
Silver Beachweed	Beach sagewort	Gum Plant
Saltbush	Coreopsis	Perennial Dune Grass species

Near Arcata at the Samoa dunes, associated with this community are representatives of adjacent woodland communities resistant to the salt breeze:

Shore Pine	Bearberry	Beach Morning Glory
Sitka Spruce	Ceanothus	

2. Coastal Salt Marsh Salt marshes along coast from sea level to 10 feet. Average rainfall 15 to 40 inches. 12-month growing season. Many of these plants exist along the Bayshore and are gradually establishing themselves along the new shore. Many plants will exist on drier sites and near fresh and brackish water marshes. Common native plant species in this community are:

Salt Grass	Pickleweed	Cord Grass
Franeknia	Seep Weed	Gum Plant

3. Fresh and Brackish Water Marshes. Near coast back of immediate salty areas from sea level to 500 feet. 12-month growing season. Common native plant species are:

Sedge	Cattail	Willow
Bullrush	Giant Horsetail	Red Alder

4. Coastal Prairie. Open temperate grasslands or bald hills. Average rainfall 25 to 40 inches. 9-month growing season. Usually associated with heavier soils. The clay, subsoil fill at the dump site is an ideal base for this plant community. Because native perennial grasses are so important for a stable natural looking landscape, the major species of this plant community are here listed and annotated:

Agrostis exarata, Spike Bentgrass. Native creeping perennial. Forms large colonies and meadows. Good for seed mix.

Bromus carinatus, California Brome. Short lived perennial grass. Will spread and seed. Good for seed mixes and as a nurse crop. Grows large and suppresses weeds.

Calamagrostis nutkaensis, Pacific Reedgrass. Plants grown in gallon cans this year. Large ornamental bunchgrass that spreads at the base. Often in pure stands with shrubs and other woody perennials. Good seeder.

Danthonia californica, California Oatgrass. Common bunchgrass in the coastal prairie. Can handle treading. Adapted well for Waterfront Park site.

Deschampsia caespitosa, Tufted Hairgrass. Common bunchgrass along coast on hillsides. Ornamental. Does well with other grasses and woody perennials.

Elymus glaucus, Blue Wildrye. Ornamental native perennial bunchgrass. Common along coast in grassland and understory. Good grass for initial seeding.

Festuca californica, California Fescue. Plants grown in gallon cans this year. Robust perennial bunchgrass. Ornamental. Does well in shady locations.

Festuca rubra, Red Fescue. Likes protected areas with some moisture to stay green. Good turf and treading grass. Many similar grasses in the seed trade; Scaldis Hard Fescue is a good example.

Hordeum brachyantherum, Meadow Barley. Good general purpose grass for most sites. Often found in pure stands and colonies.

Melica californica, Melic Grass. Ornamental perennial bunchgrass. Seeds on disturbed loose sites.

Stipa pulchra, Purple Needlegrass. ("State grass.") Common bunchgrass that does well in clay soils. Very tolerant of drought. Seeds well. Perhaps the best all-purpose grass for grassland revegetation. Ornamental. Can handle treading and resistant to grazing. Plants grown into gallon cans this year.

Stipa lepida, Foothill Needlegrass. Good for drier and hill sites. Can handle treading.

Other wildflowers and perennials associated with these grasses in the coastal prairie are:

Golden Aster	Farewell-to-Spring	Pearly Everlasting
Iris	Sea Thrift	Currant
Bracken Fern	Coyote Bush	Coast Buckwheat
Yellow Mats	Mules Ears	California Poppy
Potentilla		

5. Northern Coastal Scrub. Narrow coastal strip from southern Oregon to Pt. Sur between coastal strand and redwood forest associated with coastal prairie . Annual rainfall 25 to 75 inches, with fog and wind. 12-month growing season. This is a rich community with many aromatic and ornamental herbaceous perennials, shrubs, and trees. Common natives in this community are:

Monkey Flower	California Rose-Bay	California Rose
Pearly Everlasting	Ocean Spray	Currant
Seaside Wooly Sunflower	Manzanita species	Thimbleberry
Cow Parsnip	California Bay	Salmonberry
California Blackberry	Cascara	Swordfern
Suksdorf's Sagebrush	Wild Strawberry	Stonecrop
Elderberry	Ceanothus species	

6. Coastal Sage Scrub. Dry rocky slopes. South coast to Baja. Annual rainfall 10 to 20 inches. 8- to 12-month growing season. This plant community integrades with the northern coastal scrub and southern prairie grasslands. Common natives are:

Coast Sagebrush	Paintbrush	California Fuchsia
Wild Buckwheat	Black Sage	Evening Primrose
Lemonadeberry	Manzanita species	Live-Forever
Purple Leaved Sage	Ceanothus species	

7. Closed-Cone Pine Forest. This is a diverse and endemic coastal forest community. Interrupted forest from Mendocino plains south to Santa Barbara coastal islands.

Annual rainfall 20 to 60 inches. Much fog and wind. 9- to 12-month growing season. Trees 30 to 100 feet tall. This community borders the coastal scrub communities and the coastal prairie. Major tree and shrub species are:

Cypress species	Grand Fir	Poison Oak
Bishop Pine	Shore Pine	Madrone
Monterey Pine	Coffeeberry	Tanbark Oak
Manzanita species	Huckleberry	Red Alder
Wax Myrtle	Ceanothus species	Sitka Spruce
Coast Live Oak		

8. Coastal Oak Woodland. Parklike open woodland from Monterey County to Southern California and on the California coastal islands. Annual rainfall 7 to 20 inches. Fog and wind. This community intergrades with California's southern coastal prairies. Many beautiful and endemic trees and shrubs make up this community. Common trees and shrubs in this community are:

Island Cherry	Ironwood	Island Buckwheat species
Coast Live Oak	Manzanita species	Red Monkey Flower
Island Oak	Toyon	Giant Coreopsis
Chamise	Torrey Pine	Summer Holly

FINANCIAL

FINANCIAL STATEMENT

The following Financial Statement is current as of December 31, 1980. The \$750.00 outlay for publication is based on costs spent for production and cost estimated for printing and mailing of this report and, hopefully, up to 400 copies of a report with photographs and illustrations. \$133.44 not spent in the soils budget and the \$280.42 not spent or absorbed by the management budget (\$413.86 total) will be held for January costs and contingent circumstances until next year's funds are received. The remaining funds will be transferred into next year's management budget.

David Amme
Treasurer
Chief Project Director

Financial Statement - Balance Sheet

	<u>Budget</u>		<u>Outlay</u>		<u>Balance</u>
LIVING LABORATORY					
Greenhouse	\$1,000.		\$1,269.27		\$(269.27)
Shadehouse and Misc	600.		605.23		(5.23)
Plant & Propagation	1,000.		1,006.58		(6.58)
Soils	300.		166.56		133.44
Containers	500.		657.40		(157.40)
Publication	600.		725.00		(125.00)
Management*	4,000.		3,156.10		843.90
	<u>\$8,000.</u>	-	<u>\$7,586.14</u>	=	<u>\$ 413.86</u>
Management Breakdown:					
Copy			\$118.22		
Gas			253.52		
Film, Devel. & Serv.			278.95		
Postage			101.86		
Ins., Tax, & Fees			228.95		
Miscellaneous			652.69		
Consulting Serv.			1,200.00		
Improvements			321.91		
			<u>\$3,156.10</u>		
GRASSLAND PROJECT (California Native Plant Society)					
	\$500.		\$332.18		\$ 167.82
MEMBERSHIP AND GRANTS					
DAWN's Administration	\$465.		\$406.86		\$ 58.14
TOTAL DAWN ASSETS					\$ 639.82
ESTIMATED TOTAL DAWN ASSETS END OF PROJECT YEAR					\$ 300.00

APPENDIX

VEGETATION SURVEY OF THE BERKELEY DUMP SITE

The objective of this survey was to record species composition and abundance of plants growing at the dump site. 181 plant species were found with a few being added each week as the season advances. The plants have been divided into four groups: 1) California native plants; 2) dominating exotic weeds and grasses; 3) occasional exotic weeds; and 4) escaped cultivated plants. Attempts to estimate exact cover were not made, however, types of sites and abundance were noted.

The Site

The Berkeley dump site is on a 90-acre peninsula situated just north of the Berkeley marina. The southern half has been filled and capped for several years; the northern half is still being filled. Seven types of sites were identified for this study: compost, hard pack, mounds, wet areas, bare areas, recently disturbed areas, and mature clay soil sites that have not been disturbed for several years. Generally the top cap is a clay soil fill mixed with rocks and building debris like cement and asphalt.

- 1) Compost. Three years ago the City of Berkeley ran a compost operation on the southeastern end of the site. The raw debris accumulated too fast to keep up with the operation. The pile caught fire and had to be spread out over a large area in the center of the southern half of the dump. This partially-decomposed debris is about a foot deep above packed clay fill. In addition, this area was used as a temporary holding area for the operation and many exotic plants were imported via the gardeners who unloaded their trucks. 24 plants were found only on the compost area, most of these from group 4.
- 2) Hard pack. This includes areas of extreme soil compaction, including dirt roads and their edges.
- 3) Mounds. Large mounds of soil and fill exist on the extreme southern portion of the dump site west of the compost operation site. They average ten feet in height. The soil has not been packed and is of good quality and texture. 15 of the native plants were found only on these sites. The western most mounds have been recently destroyed and unfortunately include most of these plants.
- 4) Wet areas. These sites include areas of poor drainage where water sits for several weeks and in some cases this year up to three months. Obviously some sites were wetter than others so this category will include plants that are adapted to standing water as well as those that require mesic sites.

- 5) Bare areas. This site type is similar to the hard pack type except the soil is not packed as much. The surface is generally rough and usually had been disturbed a year or two in the past.
- 6) Disturbed areas. Areas are being disturbed throughout the year mainly by heavy equipment moving soil and debris. These types of sites are the most recently disturbed.
- 7) Mature clay soil. The term "mature" is used here to describe sites that have existed for several years without equipment disturbance. The sites are typical of completed fill areas. Annual grasses are usually dominant on these sites. This type of site closely resembles abandoned fields and roadside sites. Animal activity is high and there are many signs of gophers, rabbits, mice, and rats.

The Plants

- 1) California natives (see Table 1): Only a few natives are actively invading the site. Many were recorded from the one large mound which was destroyed. It is thought that the plants from this site were imported as seed in the parent fill. Native plants that are successful invaders at the site are: Pearly Everlasting, Coast Mugwort, Coyote Brush, California Brome, Monkey Flower, California Poppy, Tarweed, Lupine spp., Miner's Lettuce, Willow, and Blue-Eyed Grass. Only Coyote Brush, California Brome, and California Poppy are recorded in any abundance. 29 species were recorded.
- 2) Dominating exotic weeds and grasses (see Table 2): This group of plants was the most abundant. The Santa Fe - Murphy lands is the best example. 33 species were recorded. The majority of these plants are annual.
- 3) Occasional exotic weeds (see Table 3): This group of plants were not abundant but were present on a wide diversity of sites. Many are dependent upon disturbance and bare ground for establishment. About a third of the species were perennials. 66 species were recorded.
- 4) Escape exotic cultivated plants (see Table 4): This group is special to the dump site. Most of the plants were introduced by the gardeners during the compost operation and were found on the compost area. Some species such as the Acacia naturally spread in this region. Two-thirds of the species were perennials. 58 species were recorded.

Table 1. California native plants at the Berkeley dump site.

P: perennial, A: annual, C: compost, H: hard pack, M: mounds, W: wet areas, B: bare areas

D: disturbed areas, and G: mature clay soil sites usually with abundant annual grasses.

Species	Common Name	Type	C	H	M	W	B	D	G	Abundance
<i>Anaphalis margaritacea</i>	Pearly Everlasting	P	X							Few
<i>Amsinckia intermedia</i>	Fiddleneck	A			X					Few
<i>Artemisia douglasiana</i>	Coast Mugwort	P						X		Few
<i>Baccharis pilularis</i>	Coyote Brush	P						X		Many
<i>Bromus carinatus</i>	California Brome	P	X					X		Many
<i>Ceanothus</i> spp.	Ceanothus	P			X					Hit
<i>Diplacus aurantiacus</i>	Monkey Flower	P	X							Hit
<i>Epilobium adenocaulum</i>	Fireweed	P				X	X			Several
<i>Eschscholzia californica</i>	California Poppy	P-A	X		X					Many
<i>Hemizonia</i> spp.	Tarweed	A					X			Several
<i>Linanthus</i> spp.	Linanthus	A					X			Hit
<i>Lupinus arboreus</i>	Coast Lupine	P			X					Few
<i>Lupinus bicolor</i> (?)	Lupine	A			X					Few patches
<i>Lupinus nanus</i>	Sky Lupine	A			X					Several
<i>Lupinus succulentus</i>	Lupine	A						X		Few Colonies
<i>Matricaria matricarioides</i>	Matricaria	A			X					Few
<i>Montia perfoliata</i>	Miner's Lettuce	A	X							Few clumps
<i>Oenothera hookerii</i>	Evening-Primrose	P			X					Few
<i>Phacelia</i> spp.	Canterbury Bells	A			X					Few
<i>Potentilla</i> spp.	Potentilla	P			X					Few
<i>Salix</i> spp.	Willow	P			X					Hit
<i>Sambucus</i> spp.	Elderberry	P			X					Hit
<i>Scrophularia californica</i>	Figwort	P			X					Few
<i>Sisyrinchium bellum</i>	Blue-Eyed Grass	P			X					Few
<i>Solanum</i> sp.	Purple Nightshade	P						X		Hit
<i>Stachys rigida</i>	Hedge-Nettle	P			X					Few
<i>Streptanthus</i> sp.		A								Common
<i>Trifolium bifidum</i>	Clover	A			X	X				Hit
<i>Urtica holoserica</i>	Nettle	P			X					Hit

Table 2. Dominating exotic weeds and grasses.

P: perennial, A: annual, C: compost, H: hard pack, M: mounds, W: wet areas, B: bare areas,
D: disturbed areas, and G: mature clay soil sites usually with abundant annual grasses.

Species	Common Name	Type	C	H	M	W	B	D	G	Abundance
<i>Avena fatula</i>	Annual Oat	A	X		X				X	Common
<i>Brassica campestris</i>	Field Mustard	A	X						X	Common
<i>Brassica nigra</i>	Black Mustard	A	X		X				X	Very common
<i>B. rapa</i>		A	X		X					Common
<i>Bromus diandrus</i>	Ripgut Brome	A							X	Large colonies
<i>Bromus mollis</i>	Soft Chess	A	X	X			X		X	Several patches
<i>Cardamine pennsylvanica</i>	Bitter Cress	A	X							Common
<i>Carduus pycnocephalus</i>	Slender Italian Thistle	A	X		X				X	Very common
<i>Centaurea militensis</i>	Napa Thistle	A						X		Common
<i>Chenopodium album</i>	Lamb's Quarters	A	X	X	X		X	X		Common
<i>Cnicus benedictus</i>	Blessed Thistle	A								Common
<i>Conium maculatum</i>	Poison Hemlock	A	X		X				X	Large colonies
<i>Erodium moschatum</i>	Filaree	A	X				X		X	Common
<i>E. rubrum</i>	Redstem Filaree	A								Occasional
<i>Foeniculum vulgare</i>	Sweet Fennel	P	X		X				X	Occasional
<i>Lavatera cretica</i>	Tree Mallow	A	X						X	Very common
<i>Hordeum leporidum</i>	Foxtail	A	X		X			X	X	Common
<i>Lolium multiflorum</i>	Italian Rye	A	X		X				X	Common
<i>Medicago polymorpha</i>	Burclover	A					X		X	Common
<i>Melilotus indica</i>	Sweet Clover	A					X			Common
<i>Pennisetum clandestinum</i>	Kikuyu Grass	P			X				X	Several patches
<i>Picris echioides</i>	Ox Tongue	A	X		X	X	X	X	X	Common
<i>Plantago lanceolata</i>	English Plantain	P	X	X	X	X	X	X	X	Occasional
<i>Polypogon monspeliensis</i>	Rabbit-Foot Grass	A	X			X	X			Patches
<i>Raphanus sativus</i>	Wild Radish	A	X		X			X	X	Occasional
<i>Rumex crispus</i>	Curly Dock	P				X			X	Frequent
<i>Salsola kali</i>	Russian Thistle	A					X			Occasional
<i>Sisymbrium officinale</i>	Hedge-Mustard	A	X						X	Common
<i>Sonchus oleraceus</i>	Sow-Thistle	A	X		X			X		Common
<i>Silybum marianum</i>	Milk Thistle	A	X						X	Occasional
<i>Stellaria media</i>	Common Chickweed	A	X							Common
<i>Vicia sativa</i>	Spring Vetch	A					X			Common
<i>Vulpia myuros</i>	Rattail Fescue	A	X						X	Very common

Table 3. Occasional exotic weeds.

P: perennial, A: annual, C: compost, H: hard pack, M: mounds, W: wet areas, B: bare areas,
D: disturbed areas, and G: mature clay soil sites usually with abundant annual grasses.

Species	Common Name	Type	C	H	M	W	B	D	G	Abundance
<i>Amaranthus</i> spp.	Pigweed	A	X							Hit
<i>Anagallis arvensis</i>	Pimpernel	A		X			X			Occasional
<i>Anthemis cotula</i>	Mayweed	A					X			Few clumps
<i>Brassica juncea</i>	Wild Mustard	A	X							Several
<i>Briza minor</i>	Little Quaking Grass	A			X					Several
<i>Bromus rubens</i>	Red Brome	A		X			X			Occasional
<i>Calendula arvensis</i>	Calendula	A	X							Few patches
<i>Capsella bursa-pastoris</i>	Shepherd's Purse	A	X							Few patches
<i>Centaurea solstitialis</i>	Yellow Star Thistle	A						X		Few
<i>Centranthus ruber</i>	Red Valerian	A			X					Hit
<i>Chenopodium murale</i>	Nettleleaf Goosefoot	A	X							Several
<i>Chenopodium farinosum</i>	Goosefoot	A				X				Occasional
<i>Cirsium vulgare</i>	Thistle	A	X							Hit
<i>Convolvulus arvensis</i>	Bindweed	P							X	Few
<i>Conyza canadensis</i>	Horseweed	A					X			Few patches
<i>Cortaderia selloana</i>	Pampas Grass	P							X	Few patches
<i>Cotula australis</i>	Southern Brassbuttons	A	X			X				Few patches
<i>Cotula coronopifolia</i>	Brassbuttons	P				X				Few
<i>Cynara cardunculus</i>	Cardoon	P	X						X	Few patches
<i>Cynodon Dactylon</i>	Bermuda Grass	P	X		X					Few patches
<i>Cyperus</i> spp.	Umbrella-Sedge	P				X				Few patches
<i>Cytisus monspessulanus</i>	French Broom	P							X	Frequent
<i>Dipsacus</i> spp.	Teasel	A				X				Hit
<i>Ehrharta erecta</i>	Stebbin's Folly	P	X							Patches
<i>Euphorbia p. plus</i>	Petty Spurge	A	X				X	X		Frequent
<i>Galium aparine</i>	Madder	A	X							Occasional
<i>Geranium dissectum</i>	Cranesbill	A				X				Common
<i>Geranium molle</i>	Dovesfoot geranium									Occasional
<i>Geranium robertianum</i>	Herb Robert	P	X				X			Several
<i>Gnaphalium purpureum</i>	Cudweed	A					X			Few
<i>Hordeum Geniculatum</i>	Wild Barley	A					X			Occasional
<i>Hypochoeris radicata</i>	Cat's Ear	A					X			Few
<i>Juncus</i> spp.	Rush	P				X				Few
<i>Lactuca serriola</i>	Prickly Lettuce	A	X							Several
<i>Lavatera arborea</i>	Tree-Mallow	A	X							Hit
<i>Lepidium strictum</i>	Pepper Grass	A		X			X			Few
<i>Lotus</i> spp.	Bird's Foot Treefoil	A					X			Few
<i>Lythrum hyssopifolia</i>	Hyssop Lythrum	A					X			Hit
<i>Malva parviflora</i>	Mallow	A	X							Occasional
<i>Malva sylvestris</i>			X							Occasional
<i>Marrubium vulgare</i>	Horehound	P	X							Hit
<i>Medicago</i> spp.	Medick	A					X			Few
<i>Medicago arabica</i>	Spotted Medick	A					X			Few patches
<i>Melilotus alba</i>	Sweet-Clover	A				X				Few patches
<i>Oxalis corniculata</i>	Wood-Sorrel	P	X							Hit
<i>Oxalis pes-caprae</i>	Bermuda Buttercup	P	X							Few
<i>Oxalis rubra</i>	Sourgrass	A	X							Hit
<i>Poa annua</i>	Annual Bluegrass	A		X			X			Common
<i>Polygonum aviculare</i>	Common Knotweed	A			X					Hit
<i>Portulaca oleracea</i>	Purslane	A	X				X			Hit
<i>Ranunculus sardous</i>	Buttercup	P		X						Several

Table 3 (cont.)

Species	Common Name	Type	C	H	M	W	B	D	G	Abundance
<i>Rubus procerus</i>	Blackberry	P			X				X	Few
<i>Scandis pectens-veneris</i>	Shepherd's Needle	A	X							Two patches
<i>Scirpus spp.</i>	Sedge	P				X				Patch
<i>Senecio mikanooides</i>	German Ivy	P	X							Hit
<i>Senecio vulgaris</i>	Common Groundsel	A	X				X			Few patches
<i>Silene gallica</i>	Windmill Pink	A							X	Hit
<i>Solanum nigrum</i>	Nightshade	P	X							Occasional
<i>S. nodiflorum</i>		P	X							Occasional
<i>Sorghum halepense</i>	Johnson Grass	P			X					Few
<i>Sonchus asper</i>	Sow-Thistle	A	X							Frequent
<i>Spergularia rubra (?)</i>	Sand-Spurrey	A				X				Several patches
<i>Taraxacum officinale</i>	Common Dandelion	P					X			Hit
<i>Trifolium spp.</i>	Clover	A					X			Hit
<i>Trifolium repens</i>	White Clover	P					X			Occasional
<i>Urtica urens</i>	Nettle	A	X							Few clumps
<i>Vicia angustifolia</i>	Vetch	A	X						X	Frequent
<i>Vicia sativa</i>	Vetch	A			X					Several
<i>Vicia spp.</i>	Vetch	A			X					Hit

Table 4. Escape cultivated plants.

P: perennial, A: annual, C: compost, H: hard pack, M: mounds, W: wet areas, B: bare areas
D: disturbed areas, and G: mature clay soil sites usually with abundant annual grasses.

Species	Common Name	Type	C	H	M	W	B	D	G	Abundance
<i>Acacia</i> spp.	Acacia	P			X				X	Few
<i>Acacia</i> spp.	Acacia	P			X					Few
<i>Acanthus mollis</i>	Bear's Breech	P	X							Hit
<i>Agave</i> spp.	Agave	P	X							Hit
<i>Allium neapolitanum</i>	Onion	P	X							Hit
<i>Allium triquetrum</i>	Berkeley Wild Onion	P	X							Hit
<i>Althaea rosea</i>	Hollyhock	A	X							Few
<i>Antirrhinum majus</i>	Snapdragon	A	X		X					Few
<i>Aquilegia</i> spp.	Columbine	P	X							One patch
<i>Arctotis stochadifolia</i>	African Daisy	P			X					Hit
<i>Arundo donax</i>	Giant Reed	P				X				Two patches
<i>Bellis perennis</i>	English Daisy	P					X			Few plants
<i>Beta vulgaris</i>	Beet	A	X							Few
<i>Borago officinalis</i>	Borage	A	X							Few
<i>Brassica oleracea</i>	Cabbage	A	X							Few
<i>Calendula officinalis</i>	Marigold	A	X		X					Occasional
<i>Cannabis sativa</i>	Marijuana	A			X					Hit
<i>Capsicum annuum</i>	Red Pepper	A	X							Few
<i>Chrysanthemum segetum</i>	Chrysanthemum	P	X							One patch
<i>Chrysanthemum</i> spp.	Chrysanthemum	P	X							Several
<i>Cotoneaster</i> spp.	Cotoneaster	P			X					Hit
<i>Crocosmia crocosmaeflora</i>	Montbretia	P	X							Hit
<i>Cynara scolymus</i>	Artichoke	P	X							Hit
<i>Echeveria</i> spp.	Hen-and-Chickens	P	X							Hit
<i>Echium fastuosum</i>	Viper's Buglos	P	X							Few patches
<i>Eucalyptus globulus</i>	Eucalyptus	P	X							Occasional
<i>Euphorbia lathyrus</i>	Gopher plant	A	X							Several
<i>Euphorbia peplus</i>	Euphorbia	P	X							Hit
<i>Euphorbia veneta</i> (?)	Euphorbia	P	X							Hit
<i>Ficus carica</i>	Fig	P	X							Hit
<i>Hedera helix</i>	English Ivy	P			X					Hit
<i>Iris</i> spp.	Iris	P	X							Several
<i>Kniphofia ovata</i>	Red-Hot Poker Plant	P	X							Few
<i>Lathyrus latifolius</i>	Pea	A	X							Few
<i>Lathyrus odoratus</i>	Sweet Pea	P								Few
<i>Lobularia maritima</i>	Sweet Alyssum	A	X							Frequent
<i>Lycopersicum esculentum</i>	Tomato	A	X							Few
<i>Mentha spicata</i>	Spearmint	P			X					Hit
<i>Mesembryanthemum edule</i>	Ice Plant	P	X				X			Several patches
<i>Muscari</i> spp.	Grape Hyacinth	P			X					Few
<i>Nasturtium officinale</i>	Watercress	A				X				Patch
<i>Narcissus</i> spp.	Narcissus	P	X							Few
<i>Oxalis martiana</i>	Oxalis	P	X							Hit
<i>Papaver somniferum</i>	Opium Poppy	A	X							Patch
<i>Pelargonium zonale</i>	Geranium	P	X							Hit
<i>Petroselinum crispum</i>	Parsley	A	X							Hit
<i>Phoenix</i> spp. (caraniensis)	Palm	P	X							Hit
<i>Phornium tenax</i> (?)	New Zealand Flax	P	X							Hit
<i>Polygonum capitatum</i>	Knotweed	P			X					Hit
<i>Prunus cerasifera</i>	Wild Plum	P			X					Hit
<i>Ricinus communis</i>	Castor-Bean	P	X							Hit
<i>Rosa</i> spp.	Rose	P	X							Few
<i>Solanum tuberosum</i>	Potato	A			X					Hit
<i>Spartium junceum</i>	Spanish Broom	P	X							Few
<i>Tetragonia expansa</i>	Sea-Spinach	A	X							Three patches
<i>Thlaspi arvense</i>	Honesty	A	X							Hit
<i>Tropaeolum majus</i>	Nasturtium	A	X							Few
<i>Veronica buxbaumii</i>	Speedwell	P	X							Hit
<i>Zantedeschia aethiopica</i>	Calla-lily	P	X		X					Occasional

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